Signal Analysis / March 9th, 2021

List of exercises 1

The file LFP_HG_HFO.mat contains simultaneous recordings of 2 LFP channels (mV) positioned on two different hippocampal layers. These channels have been named lfpHG and lfpHFO. Sampling rate is 1000 Hz.

Write a script to execute – in dedicated blocks of code – the following:

1) Define a variable with the sampling rate value (call it srate)
2) Compute the sampling interval (dt)
3) Compute the length of the recordings (tmax)
4) Create a time vector that has the same length as the signals and contains the correspondent timings for each signal sample
5) Plot both channels simultaneously (without overlapping) from the 10^{th} to the 15^{th} second of recording
6) (Optional) Plot reference bars indicating 0.5 s (horizontal) and 0.5 mV (vertical) over the figure in 5)
7) Compute the Power Spectral Density (PSD) of each channel using Welch's method, 2-second Windows, 50% of overlap, and a numerical frequency resolution of at least 0.1Hz
8) Create 3 subplots: on the first two, make separate plots for the PSD of each channel (i.e., one PSD in each subplot); on the third subplot, plot both PSDs together. For all subplots, use X axis limits of 0 to 20 Hz. Use "Frequency (Hz)" as the title for the X axis and "Power" for the Y axis. On the first two subplots, put the channel name as the title, and for the third create a legend indicating the color corresponding to each channel.
9) Compute the average power in the theta frequency range (5 – 10 Hz) for each channel.
10) (Optional) Make a barplot using the values of average theta power for each channel. Use "Theta power" as the Y axis title and use labels to indicate, in the X axis, which bar corresponds to which channel. (Tip: for Matlab users, use set(gca,'xticklabel' , cellvariable) where 'cellvariable' is a variable of type cell containing two strings or character arrays).
11) Create two subplots. On the first, plot both PSDs together using default scaling, with X axis limits of 0 to 200 Hz. On the second, plot both PSDs again, but this time use logarithmic scaling on the Y axis.